Comprehensive Peptide Guidelines: 6 Peptide Synthesis Methods and Applications

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Abstract: Peptide is a kind of compound whose molecular structure is between amino acid and protein. It is formed by one or more amino acids in a certain order through peptide bond. Peptides are the structural fragments that make up proteins, as well as the active functional groups of proteins. They are important substances for metabolism and regulation in the human body.

Proteins are mainly absorbed in the form of peptides, which not only allow for in-depth study of protein properties, but also provide basic materials for altering and synthesizing new proteins. Studying the relationship between peptide structure and function helps to understand the efficacy of various amino acid series in peptides, in order to design peptides as short as possible while improving their physiological activity and reducing clinical adverse reactions.

Classification of peptide synthesis

There are two main pathways for peptide synthesis: chemical synthesis and biosynthesis. Chemical synthesis is mainly achieved through amino acid condensation reactions. In order to obtain synthetic peptides with a specific sequence, when the synthetic raw material contains amino acid monomers with a functional degree greater than 2, the groups that do not need to be reacted should be temporarily protected, and then a connection reaction should be carried out to ensure the directional synthesis

The chemical synthesis of peptides can be divided into solid-phase synthesis and liquid-phase synthesis, with the main difference being whether solid-phase carriers are used. There are two main strategies for peptide liquid phase synthesis: stepwise synthesis and fragment combination. Stepwise synthesis is concise and rapid, and is used for the synthesis of various bioactive peptide fragments.for example Omizzur Ltd uses both solid-phase and liquid-phase synthesis methods to complete peptide synthesis projects.

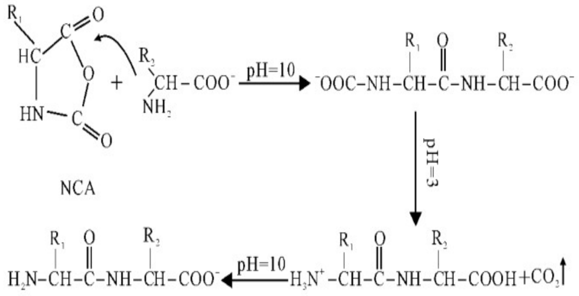
In terms of biosynthesis of peptides, in addition to commonly used fermentation methods and enzymatic hydrolysis, with the development of biotechnology, DNA recombination technology has also been applied to synthesize peptides

6 peptide synthesis methods:

1.NCA Method

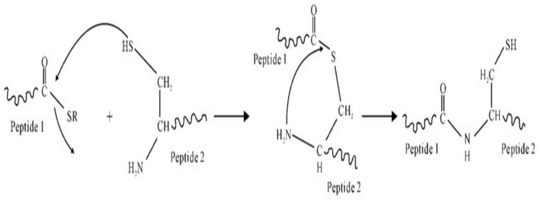
The carboxylic anhydride of amino acids is a derivative of amino acids, and its amino protecting group also activates the carboxyl group.

The NCA method has the advantages of short synthesis cycle, simple operation, low cost, and high molecular weight of the product. It accounts for a large proportion of peptide synthesis at present and the technology is also relatively universal. However, using the NCA step-by-step method can only synthesize short peptide fragments.



2.Liquid phase segmented synthesis method

The liquid phase segmented synthesis method is a synthesis method of polypeptide fragments in solution according to their chemical specificity or chemoselectivity, and the advantage is that long peptides can be obtained



3.Combinatorial chemistry method

The combinatorial chemistry method was developed on the basis of solid phase peptide synthesis in the 1980s. It connects the construction units of amino acids in a certain combination to synthesize a chemical library containing a large number of compounds, and selects a set of synthesis strategies and screening plans for compounds with certain physical, chemical or pharmacological activities from it. Different from the traditional synthesis method, the traditional synthesis method can only synthesize one compound at a time, while the combinatorial chemistry method can synthesize multiple compounds at the same time.

The combinatorial chemistry method can screen various new compounds and their isomers to the maximum extent, so as to first find the lead compounds with pharmacodynamic effects, which is a method widely used by major pharmaceutical companies in the world.

4.Enzymatic hydrolysis

Enzymatic synthesis of peptides, also known as enzymatic peptides, involves the use of biological enzymes to degrade proteins, converting large molecule proteins from animals and plants into small molecule active peptides. The enzymes used for enzymatic hydrolysis of proteins are mostly peptidases.

Enzymatic peptides have the following advantages: enzymatic hydrolysis does not reduce the nutritional value of proteins and can obtain more functions than raw food proteins; It can maintain the pure natural green nature of peptide nutrition and does not contain any chemical substances. However, enzymatic hydrolysis yields a series of peptides, which are difficult to separate and purify, making them unsuitable for synthesizing a single peptide.

5.Genetic engineering method

The birth of DNA recombination technology laid the foundation for synthesizing peptides with determined sequences, which can be controlled by designing appropriate DNA templates. By utilizing DNA recombination technology, a variety of bioactive peptides can be efficiently synthesized in large quantities by engineering bacteria produced by recombinant DNA.

The genetic engineering method for synthesizing peptides has the advantages of strong expression directionality, product safety and hygiene, wide source of raw materials, and low cost. It can obtain high-quality, effective, and naturally active peptide drugs. However, there are technical difficulties such as efficient expression, separation difficulties, low yield, and high cost, making it difficult to use in large-scale production

6.Fermentation method

Fermentation is a method of extracting peptides from metabolites produced by cultured microorganisms. The advantages of fermentation method are low industrialization cost, but narrow product range and complex product purification.

Application of peptides

At present, the application of peptides mainly focuses on peptide drugs, peptide drug carriers, tissue engineering materials, and peptide nutritional foods

1.Peptide drug
Besides peptide hormones, peptide vaccines can be used to prevent SARS virus, hepatitis, AIDS and other viral infectious diseases; Peptides that specifically bind to oncogene targets can be used to treat tumors. Screening cytokine mimic peptides from peptide libraries; Multiple antimicrobial peptides can kill tumor cells; Some small peptides isolated from natural plants can treat cardiovascular diseases, etc.

2.Peptide drug carriers

Peptides can be used as drug carriers, both as modifiers and as the main components of drug carriers

3.Tissue Engineering Materials
Some non bioactive polymer peptides, such as polyaspartic acid, polylysine, polyglutamic acid, etc., have gradually become a new type of material with great application prospects in tissue engineering due to their good biocompatibility, controllable biodegradation rate, modifiability, and controllability of designed plastic structures

4.Peptide nutritional food
As a new type of health food, active peptide foods have unique characteristics and functions, and also have many advantages in nutrition. They have broad application prospects in the food industry.

According to different sources, active peptide nutritional foods mainly include the following categories: milk protein peptide products, plant peptide products, collagen peptide products, livestock and aquatic peptide products, etc

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